Title: Apple Orchard

Brief Overview:

This unit focuses on measurement. The students will work on area and perimeter and analyze a coordinate grid. At the end of the unit, the students will design an apple orchard and write a letter (or make a poster or video) to persuade an orchard owner to use his/her design to expand the orchard.

NCTM 2000 Principles for School Mathematics:

Equity: *Excellence in mathematics education requires equity - high expectations and strong support for all students.*

Curriculum: *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*

Teaching: *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*

Learning: *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*

Assessment: *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*

Technology: *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

Content Standards

and nature of the computation and use the selected method or tools.

<u>Algebra</u>

Understand patterns, relations, and functions; and represent and analyze patterns and functions, using words, tables, and graphs.

Use mathematical models to represent and understand quantitative relationships; and model problem situations with objects and use presentations such as graphs, tables, and equations to draw conclusions.

Analyze change in various contexts; investigate how a change in one variable relates to a change in a second variable; and identify and describe situations with constant or varying rate of change and compare them.

Geometry

Specify locations and describe spatial relationships using coordinate geometry and other representational systems; describe location and movement using common language and geometric vocabulary; make and use coordinate systems to specify locations and to describe paths; and find the distance between points along horizontal and vertical lines of a coordinate system.

Use visualizations, spatial reasoning, and geometric modeling to solve problems; build and draw geometric objects; create and describe mental images of objects, patterns, and paths; identify and build a three-dimensional object from two-dimensional presentations of that object; identify an draw a two-dimensional representation of a three-dimensional objects; use geometric models to solve problems in other areas of mathematics, such as number and measurement; and recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.

Measurement

Understand measurable attributes of objects and the units, systems, and processes of measurement; understand such attributes as length and area, and explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way.

Apply appropriate techniques, tools, and formulas to determine measurements, develop strategies for estimating the perimeters and areas of irregular shapes; select and apply appropriate standard units and tools to measure length, and area.

Data Analysis and Probability

Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them; collect data using observations, surveys, and experiments; and represents data using tables and graphs.

Develop and evaluate inferences and predictions that are based on data; and propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions.

Process Standards

Problem Solving

Instructional programs from pre-kindergarten through grade 12 should enable all students to build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical problem solving.

Reasoning and Proof

Instructional programs from pre-kindergarten through grade 12 should enable all students to recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof.

Communication

Instructional programs from pre-kindergarten through grade 12 should enable all students to organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; and the language of mathematics to express mathematical ideas precisely.

Connections

Instructional programs from pre-kindergarten through grade 12 should enable all students to recognize and use connections among mathematical ideas; understand how mathematical ideas interconnect and build on one another to produce a coherent whole; and recognize and apply mathematics in context outside of mathematics.

Representation

Instructional programs from pre-kindergarten through grade 12 should enable all students to create and use representations to organize, record, and communicate mathematical ideas; select, apply, and translate among mathematical representations to solve problems; and use representations to model and interpret physical, social, and mathematical phenomena.

Links to National Science Education Standards:

Unifying Concepts and Processes
Life Science
Science in Personal and Social Perspectives
History and Nature of Science

Grade/Level:

Grades 2-4

Duration/Length:

This unit will take approximately four to five class periods of approximately 60 minutes each.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

Elements of a map
Graphing and data analysis
Working cooperatively with a partner
Understanding of area and perimeter
Measuring in units

Friendly letter format
Persuasive writing skills

Student Outcomes:

Students will:
Locate points on a coordinate grid.
Determine area and perimeter.
Describe location and movement using geometric vocabulary.
Construct and analyze a graph.
Create a model.
Write a persuasive letter or poster.
Work cooperatively with a partner (buddy edit).
Make real life connections.

Materials/Resources/Printed Materials:

Johnny Appleseed by Steven Kellogg
Apple Picking Time by Michele Slawson
Apples by Gail Gibbons
Masking tape
Teacher generated X and Y axis numbers (use different colors for each axis)
Pot (to use as "Johnny's hat") and a lunch bag decorated with an apple (optional)
Large chart, graph and butcher paper for class display
Individual copies of apples
Crayons or markers
Centimeter cubes or linker cubes (have available for those that need manipulatives)
Overhead projector and markers
Teacher Resource Sheet # 1 (make into transparencies)
Student Resource Sheets # 1-13

Development/Procedures:

Day 1 – Coordinate Grid

Gather students in the reading area. Set purpose for reading. Say: Today we will be reading a story about Johnny Appleseed. Johnny traveled in the United States planting appleseeds wherever he went. Today in math, we will be learning how to give directions to locate things on a grid. Read Johnny Appleseed by Steven Kellogg. Discuss how Johnny moved around in the story.
Prepare a grid on the floor using masking tape and number labels (use different colors for each axis). Place an "over" sign next to the X-axis. Place an "up" sign next to the Y-axis. Make the zero out of a third color.
Refer to grid on floor. Tell students that locations of a person or object are given by stating

where the two lines on a grid intersect. The first number stated is the number that is counted over (horizontally). The second number stated is the number that is counted up (vertically). Place a pan on your head. Grab your bag of apple seeds and jump to an intersection on the grid. Ask students to give your location on the grid. Remind them to give the "over location first, followed by the up location. Jump from intersection to intersection, each time eliciting the grid coordinates from various students.

Call on different students to play the role of Johnny Appleseed. Students will continue to practice giving locations on the coordinate grid.

Relate the grid to street intersections and map reading skills used in Social Studies.

Send students back to seats. Distribute Student Resource Sheets #1 and #2. Display on overhead. Ask students to put their finger on Johnny "A" on the grid. Next ask student to give coordinate grid location. Have each student record (2, 6) next to the Johnny "A" on the answer sheet. Students complete the rest of the worksheet independently.

Discuss the concepts covered. Discuss real life applications and why it is useful to know coordinate grid locations.

Day 2

Warm Up

Give a brief review of the concepts presented on Day 1. Using a blank coordinate grid (Student Resource Sheet #3) have students mark the numbers on the X and Y-axis. Students should draw objects at various intersections on the grid. Ask students to identify the location of each object. This will provide a quick assessment of students' understanding of previous lesson.

Procedure

Call students to reading area. Read Apples by Gail Gibbons. Discuss the various types of apples and where they are grown. Ask the students what they think a farmer needs to know when planning his/her orchard. Make a web and record responses on chart paper. Guide student responses toward fencing in the farmland.

Introduce the concept of perimeter. Perimeter refers to the distance around the edge of something. A fence covers the distance around a yard or orchard. Ask students to name other examples of perimeter. Prompt them with the example of a basketball rim or the rim of a trashcan. Point out that the word pe**rim**eter has the word **rim** in it.

Using overhead, show Student Resource Sheet # 4, and guide students by making hatch marks around shapes to determine the perimeter. Explain your thinking and have students count with you as you find the perimeter of one example. Stress that units must accompany the numerical answer.

Distribute Student Resource Sheet #4 to each student. Go over directions. Students complete the rest of the worksheet independently.

Discuss the area inside the shapes. Ask if anyone knows what this region is called. Tell students that this region is called area. Ask why it would be useful to know the area of something. (Prompt with examples of their room, yard or a farm, if needed.)

Using Student Resource Sheet #4, direct students to look at first shape. Instruct the students to find the perimeter of the first shape. Remind them to make hatch mark and

label the perimeter with units. Now direct them to look inside the fence and number each square located within. The total number of squares equals the area. Teacher models and writes in on the overhead.

Ask the students to tell the difference between area and perimeter and the trick that helps them to remember the difference. (The word rim in perimeter reminds us that we are measuring the rim or outside of some object.)

Ask the students to discuss the ways in which knowing the area would be useful. Web responses on chart paper. Have students complete the other examples on Student Resource Sheet #4 independently. (See Student Resource Sheet # 4 Answer Key.)

Distribute Student Resource Sheet #5. Read directions. Do number one together as a class. Students complete the remainder of the worksheet independently. (See Student Resource Sheet # 5 Answer Key.)

Direct the students to list in their math journals the ways in which knowing the area and perimeter of a shape is useful in real life situations.

Day 3

Warm Up

Prepare a graph (using butcher paper) with the heading "Our Favorite Type of Apples". Mark the Y-axis with labeled apples (use appropriate color for each apple type). Label the X-axis with numbers.

Refer to Apples to review types of apples. Limit selection to include red delicious, golden delicious, and Granny Smith apples.

Distribute small apple picture (Student Resource Sheet #6) and a piece of masking tape. Students will color apple to correspond with their favorite type and adhere their apple to the appropriate place on the pictograph.

Procedure

Read Apple Picking Time by Michele Slawson. Discuss family life in rural communities. Recall prior knowledge about area and perimeter and how it is related to orchards.

Read vignette (writing prompt) to students (Teacher Resource Sheet #1). Put on overhead.

Give expectations as listed on student buddy checklist (Student Resource Sheet #7).

Model possible orchard plan on overhead.

Distribute Student Resource Sheets #8 or 9 and # 10. Students work independently to complete orchard plan.

Distribute student buddy checklist (Student Resource Sheet #7). Students peer conference-using checklist.

Pick one or two orchard plans to share with entire group.

Day 4

Warm up

Review parts of a friendly letter.
Review criteria from buddy checklist.
Allow students time to correct orchard plans.

Procedure

Brainstorm ways to persuade. Chart responses.
Inform the students that they will now be writing a letter or creating a poster to convince Mr. Butler to adopt their orchard plan.
Discuss expectations for the letter, or poster. Distribute rubric (Student Resource Sheet # 11).
Allow students time to work on letter.
Conference with teacher to edit letter or poster. Make final copy using best handwriting.
Use apple stationery for final copy (Student Resource Sheet # 12).

Performance Assessment:

Assessment will be on going, utilizing student work samples, classroom observation throughout the unit and culminating conference with teacher.

Work Samples:

Day 1 – Formative assessment – teacher observations and anecdotal record during the over and up floor game
Day 2 - Post assessment from Day 1– Give student a blank grid. Provide students with symbol labeled coordinates. The students will draw the symbols at the appropriate intersections. Student Resource Sheet # 3.
Formative Assessment Student Resource Sheet # 4.
Day 3 - Post assessment from Day 2 - Final Orchard Model done on Student Resource Sheets #8 or #9 and # 10 following rubric presented on Student Resource Sheet # 7.
Day 4 – Final copy of persuasive letter written to orchard owner based on rubric presented on Student Resource Sheet #11.

Extension/Follow Up:

Orchard Plans will be put on display for other members of the school community to observe.
Additional practice in measuring perimeter and area will be provided in math center area.
Additional practice in plotting points on a grid will be provided in math center area. Student Resource Sheet #13.
An apple grid cake shared in class to help students remember how coordinate grid are read. Ask, "Where is Johnny Now?" After the coordinates are given, ask the students to determine the area of the squares on the cake. Relate rows to repeated addition and multiplication concepts.

Curriculum extensions:

Language arts and literature – provide other versions of Johnny Appleseed story and non-fiction informational books on growing apples for students to peruse in a reading center.
Read to perform a task – Students read directions to plant an apple seed. Write step-by-step directions to inform others how to plant a seed.
Science – Cut an apple horizontally to observe a star shape. Students can look for pictures of apple blossoms on the Internet.
Technology – Students can access math games @ Primary Games.com and NCTM.com
Make a class wed site displaying student work with links to math games. Make a persuasive video commercial.

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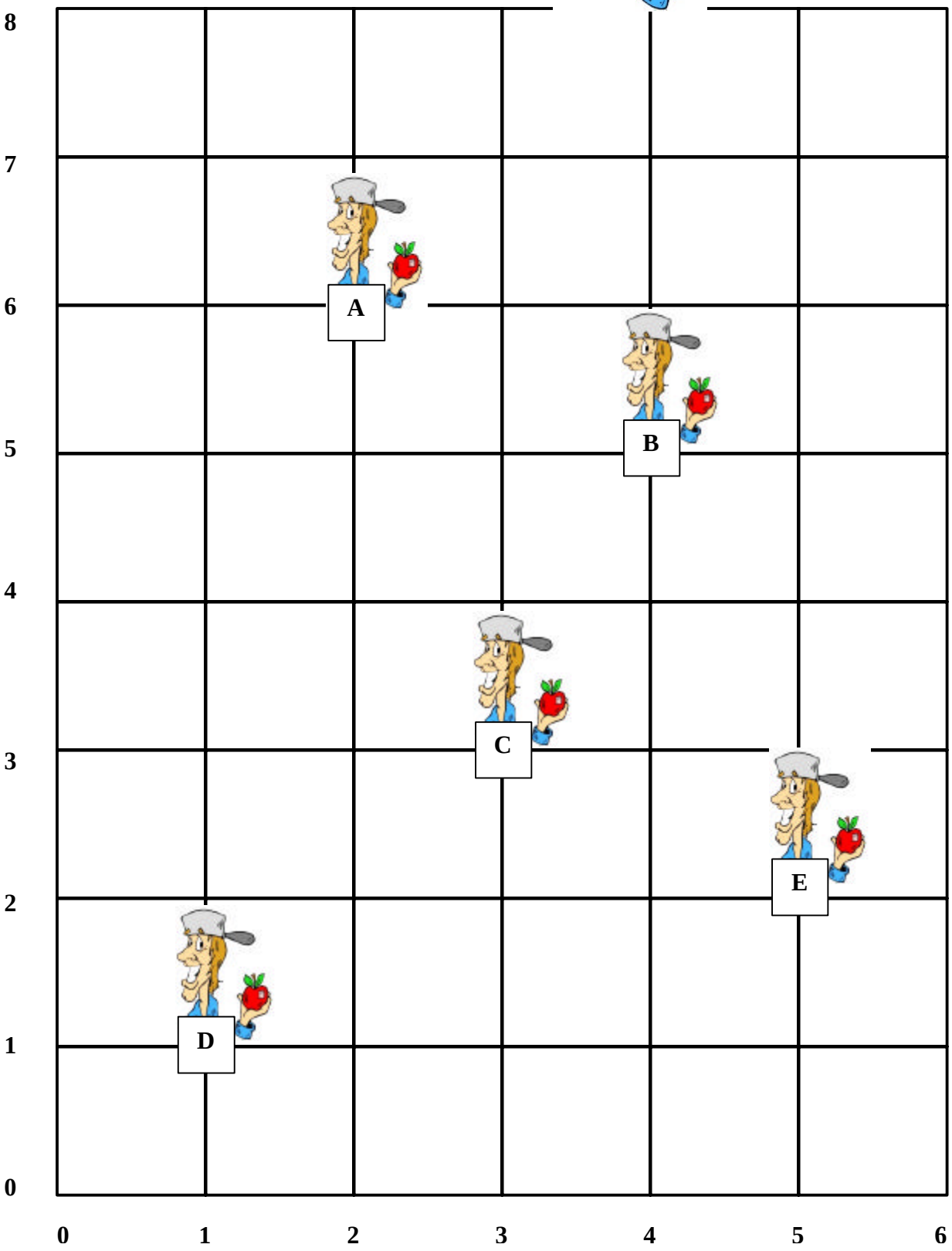
Apple Orchard

Area and Perimeter

Butler's Orchard wants to plant a new apple orchard. You have your own fencing company and seed store. You are going to design an orchard, complete with fencing. You will write a letter or create a poster to persuade Mr. Butler to use your company.

Use the grid paper to design the orchard. First draw a pond and a barn at the following locations: barn at coordinate grid location (1,1) and pond at coordinate grid location (4,5). Make sure to designate the area for each type of apple you will be planting, and include a key to identify the location of each type of apple as well as your pond and barn. Determine the perimeter of the **entire** orchard that you will be fencing in for Mr. Butler.

Directions: Write the coordinates for each Johnny on your answer sheet.



Johnny On The Grid Answer Sheet

Write the location for each "Johnny" below. Remember that the first blank is for the number over and the second blank is for the number up.

_____ , _____

_____ , _____

_____ , _____

_____ , _____

_____ , _____

Draw the following shapes at the correct intersections on the grid below.

 **(4, 3)**

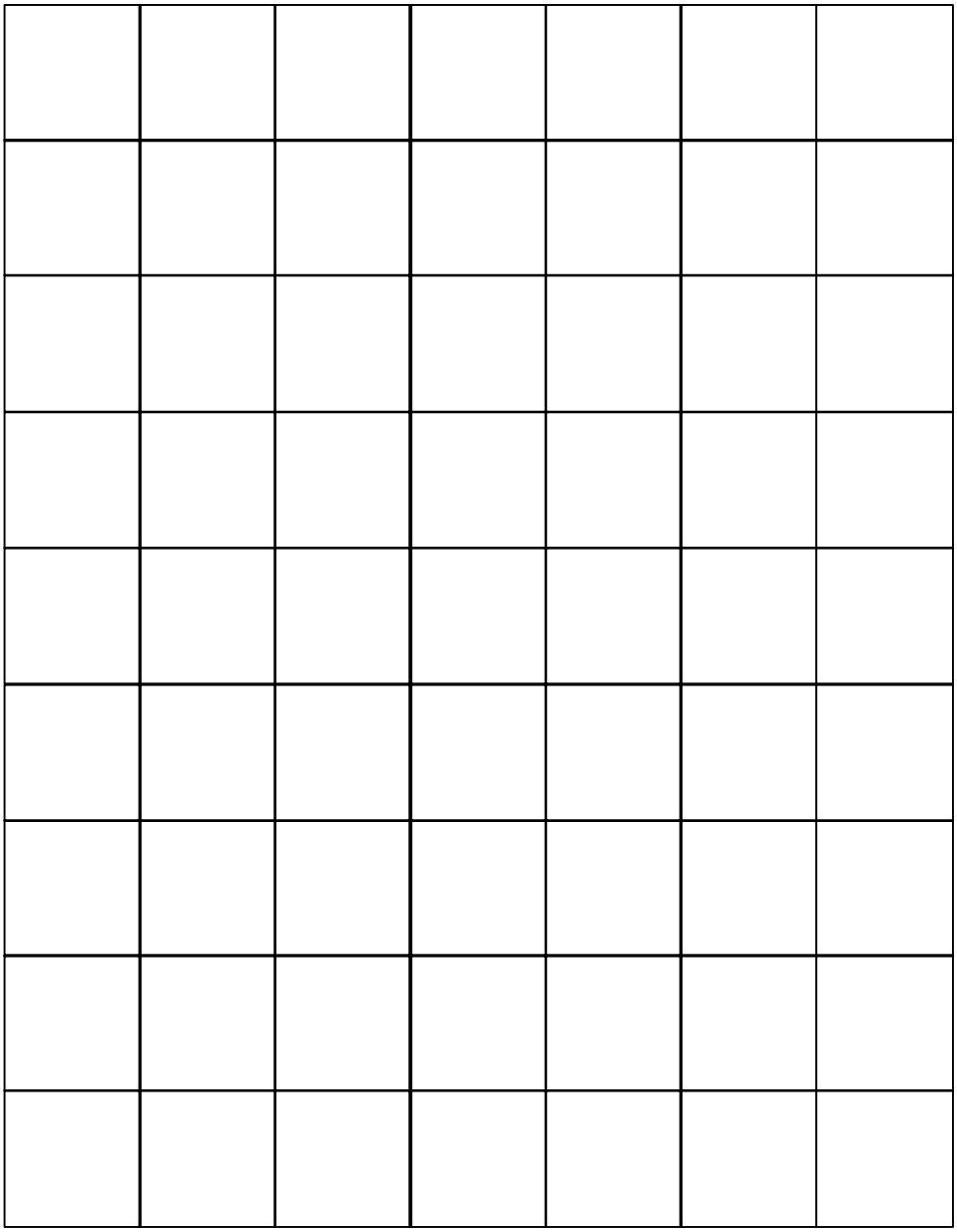
 **(2, 2)**

 **(1, 2)**

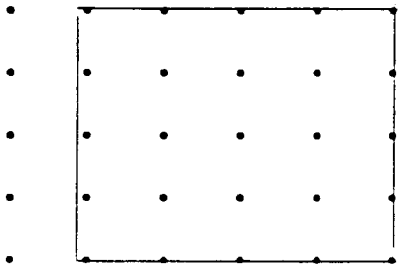
 **(2, 7)**

 **(3, 5)**

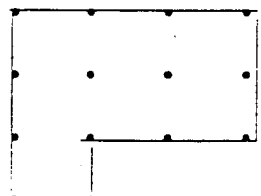
 **(5, 7)**



Name _____ Date_____



P= ---------- units



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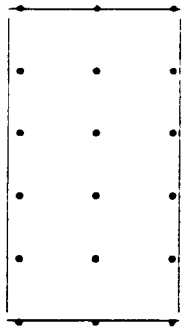

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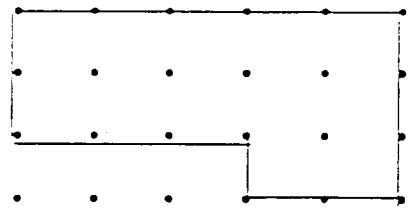
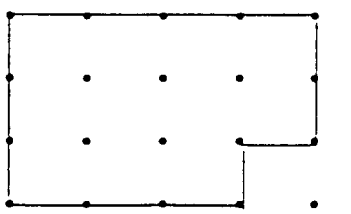
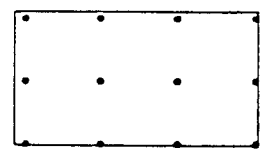


P= ---------- units

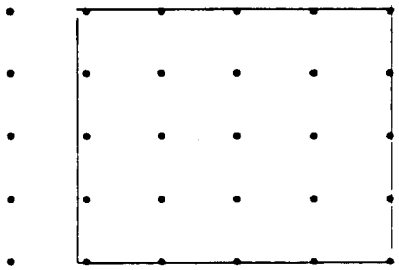


P= ---------- units

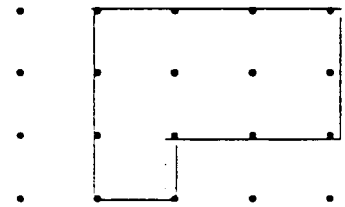


P= ---------- units

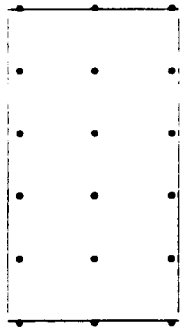
Name _____ Date_____



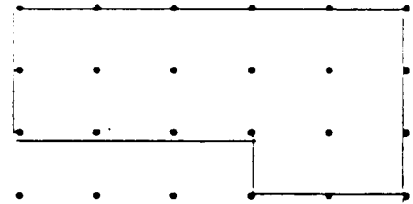
P= 16 units



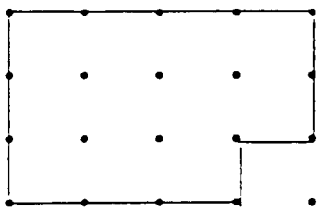
P= 12 units



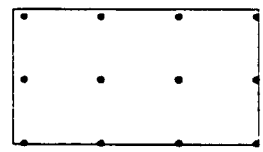
P= 14 units



P= 16 units



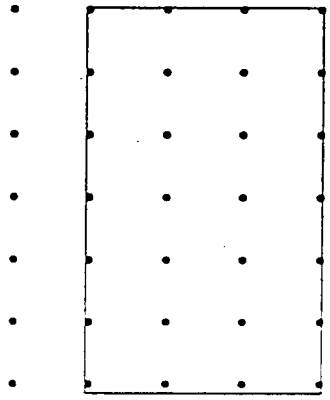
P= 14 units



P= 10 units

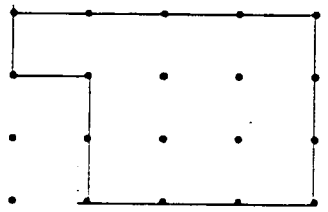
Name _____ Date_____

Find the perimeter and the areas of each shape.
Record your answers on the proper line.



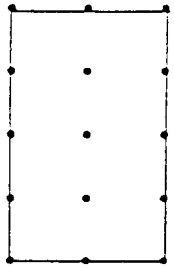
P= ---------- units

A= ---------- square units



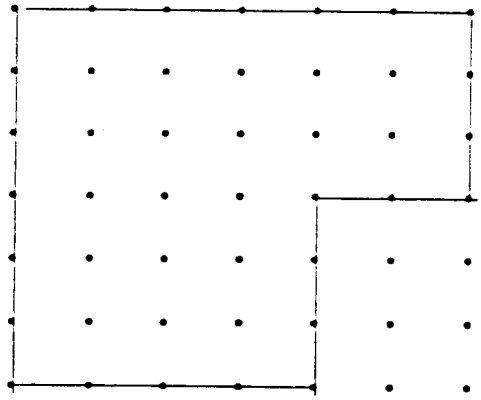
P= ---------- units

A= ----------square units



P= ---------- units

A= ---------- square units



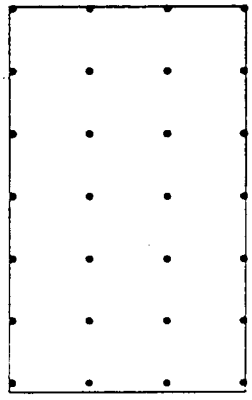
P= ---------- units

A= ---------- square units

Student Resource Sheet # 5
ANSWER KEY

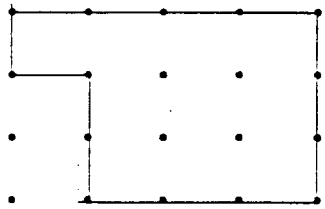
Name _____ Date _____

Find the perimeter and the areas of each shape.
Record your answers on the proper line.



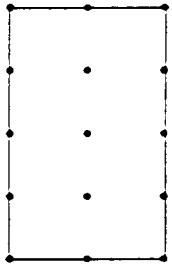
P= 18 units

A= 18 square units



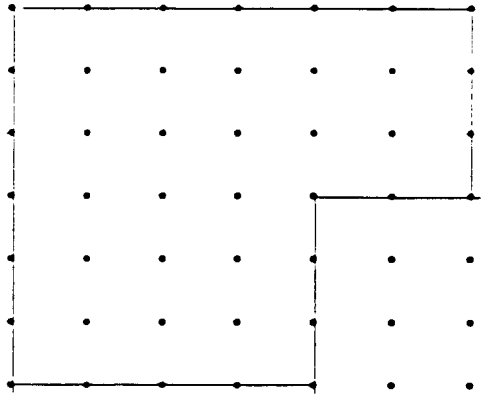
P= 14 units

A= 10 square units



P= 12 units

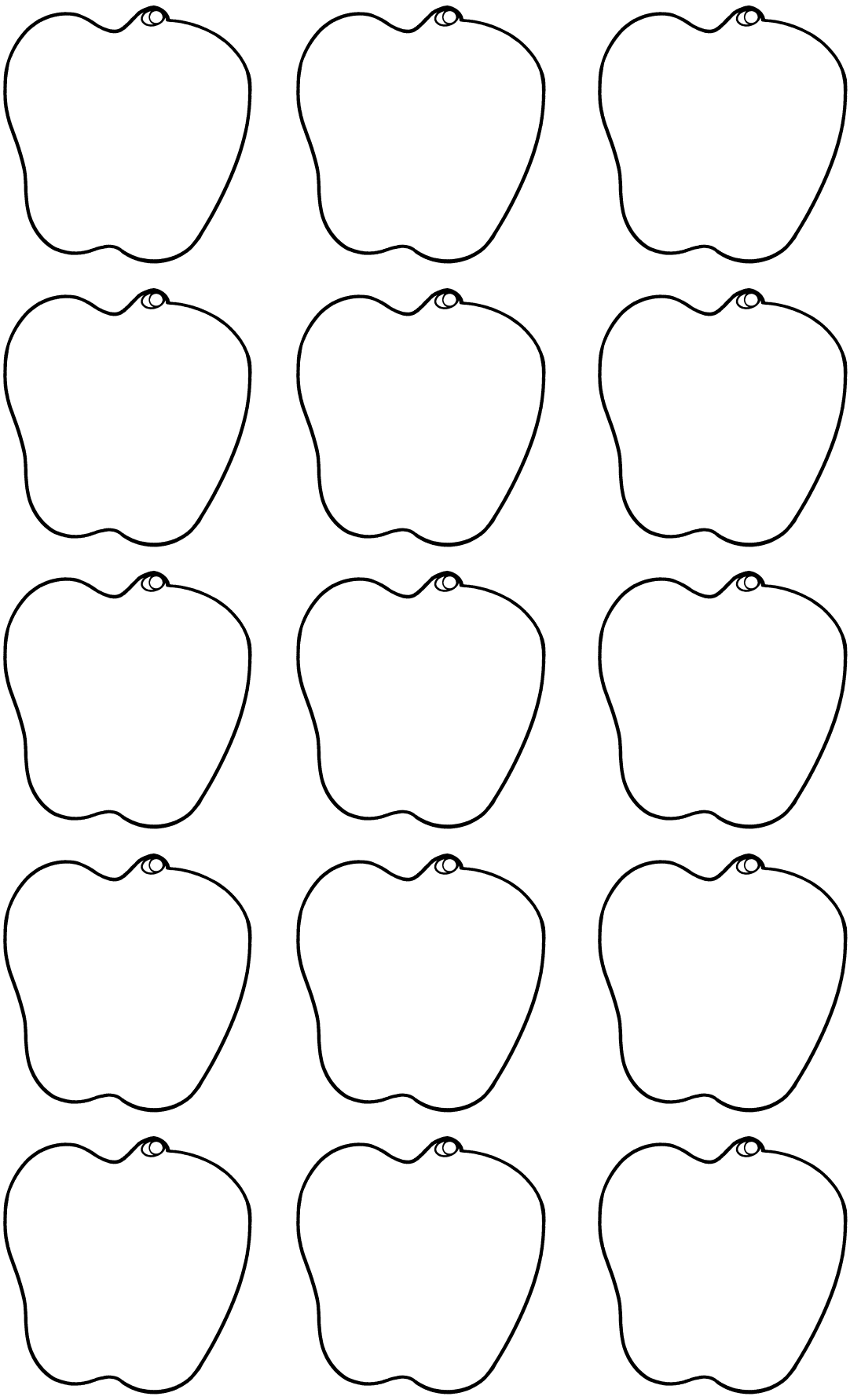
A= 8 square units

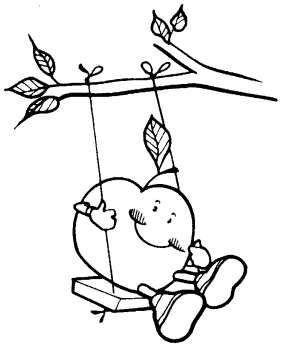


P= 22 units

A= 26 square units

Student Resource Sheet #6

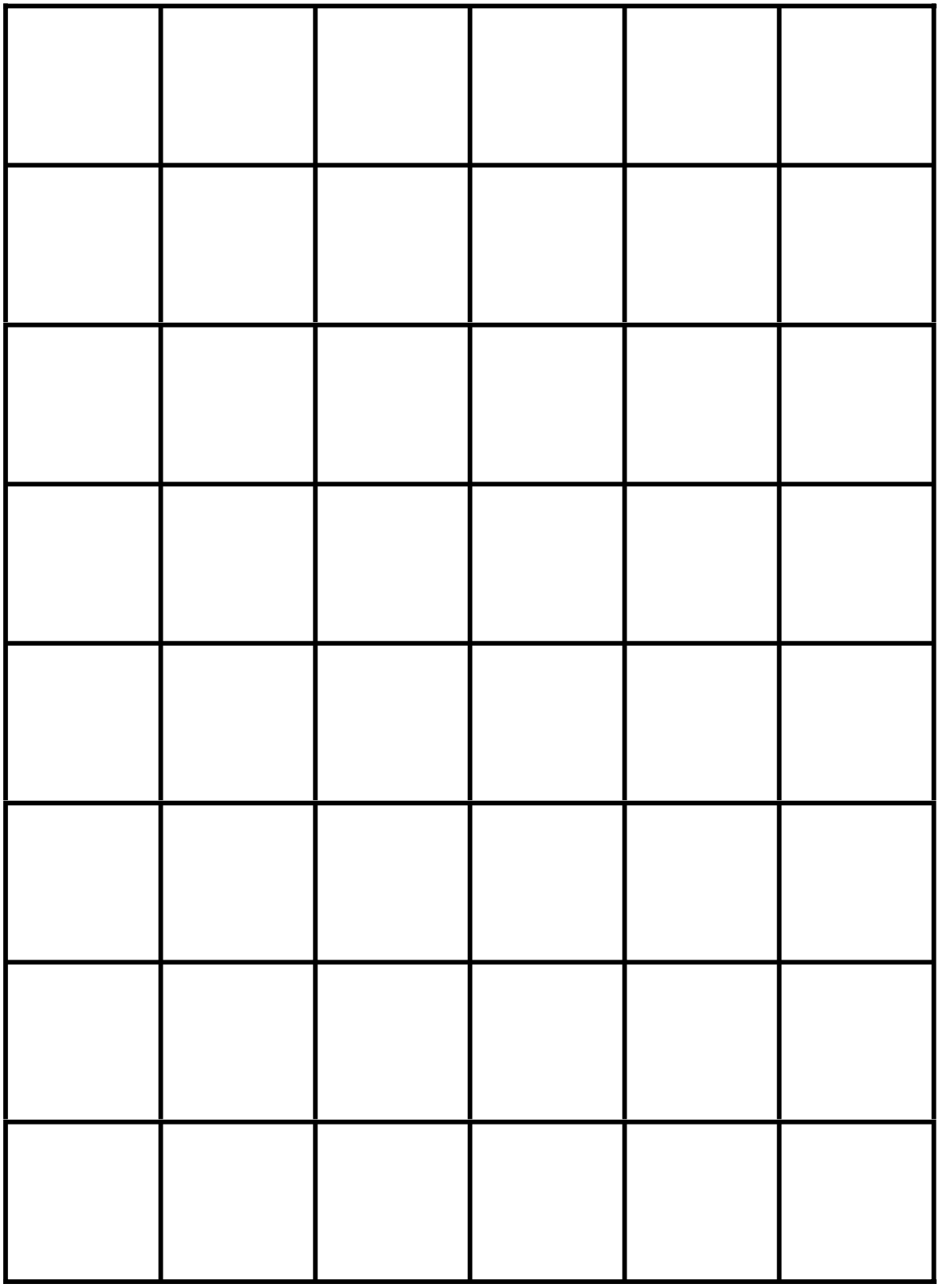




Student Buddy Checklist
(Rubric for Orchard Model Map)

Make a check in each box to show that your partner has done the task correctly or if it needs improvement.

	Good Job	Needs Improvement
Title on your model	☐	☐
Compass rose	☐	☐
Key including pictures of three types if apples	☐	☐
Key including barn and pond	☐	☐
Record – perimeter of your entire orchard	☐	☐
Record – area of each different type of apple	☐	☐



Coordinate Assessment

Your Name: _____

Company's name: _____

Granny Smith Apple Trees Area: A=_____

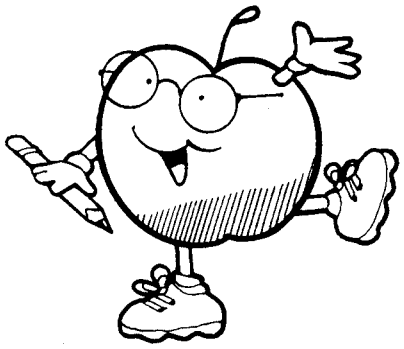
MacIntosh Apple Trees Area: A=_____

Golden Delicious Apple Trees Area: A=_____

Perimeter of the entire orchard: P=_____

List three reasons why Mr. Butler should choose your company.

1. **_____**
2. **_____**
3. **_____**



Rubric for Letter

3 Letter form is correct including date, greeting, body, closing, and signature.
Persuasive letter includes at least three reasons to convince the owner to choose your orchard plan.
Cost of your project is included in your letter.
0-4 grammatical errors (capitalization, organization, punctuation, and spelling)

2 Two of the above are incomplete.
5-7 grammatical errors

1 -Three of the above are incomplete.
More than 7 grammatical errors

0 Blank, off-topic, or illegible response

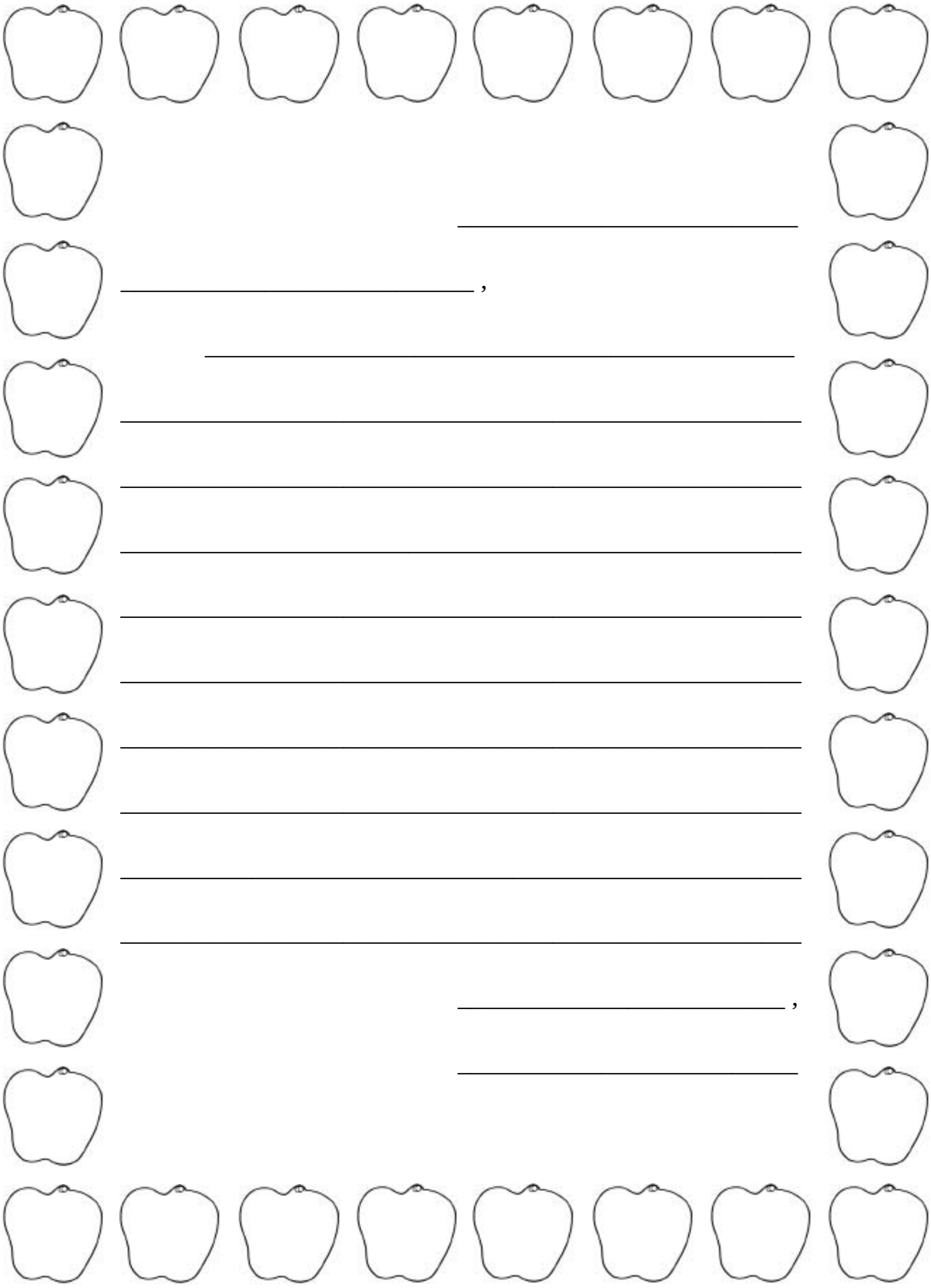
Rubric for Poster

3 Poster is eye-catching and colorful.
Poster includes your name and the name of your company.
Poster includes three persuasive words or phrases that might persuade orchard owner to choose your plan.
Poster includes the cost of your plan.
0-3 grammatical errors (capitalization, organization, punctuation and spelling

2 Two of the above are incomplete
4-5 grammatical errors

1 Three of the above are incomplete
6-7 grammatical errors

0 Incomplete, blank or off-topic



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Name _____ Date _____